Designation: ~~D4362 – 08~~ D4362 – 13

Standard Specification for Propane Thermophysical Property Tables[1]

This standard is issued under the fixed designation D4362; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The thermophysical property tables for propane are ~~for use~~ used in ~~the calculation of the~~ calculating the pressure-volume-temperature (PVT), thermodynamic, and transport properties of propane for process design and operations. ~~Tables are provided for gaseous and liquid propane at temperatures between 90 and 600 K at pressures to 20 MPa. One table provides properties at the conditions of liquid-vapor equilibrium (saturation properties). The other~~ Two tables provide properties at the conditions of liquid-vapor equilibrium (saturation properties), one for liquid and one for vapor, at temperatures between 90K and the critical point, 380K. A third table provides properties at selected *T*,*p* points for the equilibrium phase at ~~those conditions.~~ temperatures between 90K and 600K at pressures to 20 MPa. The tables were developed by the National Institute of Standards and Technology from a Standard Reference Database product REFPROP, version ~~8.0.~~9.0.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Applicability

2.1 These tables apply ~~directly~~ only to pure gaseous propane. ~~However, it is expected that they may find substantial use~~They may also be used in mathematical models and tables for the thermophysical properties of mixtures containing propane.

3. Tables

3.1 These tables were produced by equations from a computer package, "NIST Standard Reference Database 23; Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 9.0."[2] A wide selection of units (SI units, engineering units, chemical units) and additional properties are available with this program.

3.2 These thermophysical property tables are:

3.2.1 *Thermophysical Properties of ~~Coexisting Gaseous and Liquid Propane,~~ Propane Liquid at Vapor-Liquid Equilibrium,* in SI units. See Table 1.

3.2.2 *Thermophysical Properties of Propane Vapor at Vapor-Liquid Equilibrium,* in SI units. See Table 2

3.2.3 *Thermophysical Properties of Propane Along Isobars,* in SI units. See Table ~~2~~3.

3.3 The ~~tabulated thermophysical properties~~ symbols are:

T, temperature (K)
ρ, molar density (~~mol·l~~(mol·L^{-1})
H, molar enthalpy (J·mol^{-1})
S, molar entropy (J·K^{-1}·mol^{-1})
C_v, constant volume molar heat capacity (J·K^{-1}-·mol^{-1})
C_p, constant pressure molar heat capacity (J·K^{-1}·mol^{-1})
c, speed of sound (m·s^{-1})
η, viscosity (μPa·s)
λ, thermal conductivity (mW·m^{-1}·K^{-1})

3.4 The tabulated thermophysical properties are:

ρ, molar density (mol·L^{-1})
H, molar enthalpy (J·mol^{-1})
S, molar entropy (J·K^{-1}·mol^{-1})

[1] This specification is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.08 on Thermophysical Properties.

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[2] Available from Standard Reference Data, National Institute of Standards and Technology (NIST), 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899.

TABLE 1 Thermophysical Properties of ~~Coexisting Gaseous and Liquid Propane~~

T K	p MPa	ρ ~~mol·l^{-1}~~	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
~~90~~	~~9.69E-10~~	~~16.520~~	~~-21348~~	~~87.53~~	~~59.51~~	~~84.64~~	~~2106.1~~	~~7395~~	~~206.6~~
~~90~~	~~9.69E-10~~	~~1.3E-09~~	~~3270.8~~	~~361.07~~	~~31.24~~	~~39.55~~	~~146.59~~	~~2.744~~	~~1.919~~
~~92~~	~~1.98E-09~~	~~16.473~~	~~-21178~~	~~89.40~~	~~59.42~~	~~84.73~~	~~2092.4~~	~~6359~~	~~206.0~~
~~92~~	~~1.98E-09~~	~~2.59E-09~~	~~3350.2~~	~~356.01~~	~~31.58~~	~~39.90~~	~~148.03~~	~~2.790~~	~~2.017~~
~~94~~	~~3.91E-09~~	~~16.426~~	~~-21009~~	~~91.22~~	~~59.34~~	~~84.82~~	~~2078.8~~	~~5518~~	~~205.4~~
~~94~~	~~3.91E-09~~	~~5E-09~~	~~3430.4~~	~~351.21~~	~~31.93~~	~~40.25~~	~~149.46~~	~~2.837~~	~~2.115~~
~~96~~	~~7.49E-09~~	~~16.379~~	~~-20839~~	~~93.00~~	~~59.27~~	~~84.92~~	~~2065.1~~	~~4827~~	~~204.7~~
~~96~~	~~7.49E-09~~	~~9.39E-09~~	~~3511.2~~	~~346.65~~	~~32.28~~	~~40.59~~	~~150.88~~	~~2.884~~	~~2.214~~
~~98~~	~~1.39E-08~~	~~16.333~~	~~-20669~~	~~94.76~~	~~59.21~~	~~85.02~~	~~2051.5~~	~~4254~~	~~203.9~~
~~98~~	~~1.39E-08~~	~~1.71E-08~~	~~3592.7~~	~~342.32~~	~~32.62~~	~~40.94~~	~~152.28~~	~~2.932~~	~~2.315~~
~~100~~	~~2.53E-08~~	~~16.286~~	~~-20499~~	~~96.48~~	~~59.15~~	~~85.12~~	~~2037.8~~	~~3774~~	~~203.2~~
~~100~~	~~2.53E-08~~	~~3.04E-08~~	~~3674.9~~	~~338.21~~	~~32.96~~	~~41.28~~	~~153.66~~	~~2.979~~	~~2.417~~
~~102~~	~~4.46E-08~~	~~16.240~~	~~-20328~~	~~98.16~~	~~59.10~~	~~85.23~~	~~2024.1~~	~~3369~~	~~202.4~~
~~102~~	~~4.46E-08~~	~~5.26E-08~~	~~3757.8~~	~~334.30~~	~~33.30~~	~~41.62~~	~~155.03~~	~~3.027~~	~~2.520~~
~~104~~	~~7.7E-08~~	~~16.193~~	~~-20158~~	~~99.82~~	~~59.06~~	~~85.34~~	~~2010.4~~	~~3024~~	~~201.6~~
~~104~~	~~7.7E-08~~	~~8.91E-08~~	~~3841.4~~	~~330.58~~	~~33.634~~	~~41.95~~	~~156.39~~	~~3.075~~	~~2.624~~
~~106~~	~~1.3E-07~~	~~16.147~~	~~-19987~~	~~101.44~~	~~59.02~~	~~85.45~~	~~1996.7~~	~~2729~~	~~200.8~~
~~106~~	~~1.3E-07~~	~~1.47E-07~~	~~3925.6~~	~~327.04~~	~~33.97~~	~~42.28~~	~~157.73~~	~~3.123~~	~~2.730~~
~~108~~	~~2.14E-07~~	~~16.101~~	~~-19816~~	~~103.04~~	~~58.98~~	~~85.56~~	~~1983.0~~	~~2475~~	~~200.0~~
~~108~~	~~2.14E-07~~	~~2.39E-07~~	~~4010.5~~	~~323.66~~	~~34.30~~	~~42.61~~	~~159.06~~	~~3.172~~	~~2.836~~
~~110~~	~~3.47E-07~~	~~16.055~~	~~-19645~~	~~104.61~~	~~58.96~~	~~85.68~~	~~1969.4~~	~~2255~~	~~199.1~~
~~110~~	~~3.47E-07~~	~~3.8E-07~~	~~4096.1~~	~~320.44~~	~~34.62~~	~~42.94~~	~~160.38~~	~~3.220~~	~~2.944~~
~~112~~	~~5.51E-07~~	~~16.008~~	~~-19473~~	~~106.16~~	~~58.93~~	~~85.80~~	~~1955.7~~	~~20623~~	~~198.2~~
~~112~~	~~5.51E-07~~	~~5.92E-07~~	~~4182.3~~	~~317.37~~	~~34.95~~	~~43.26~~	~~161.69~~	~~3.269~~	~~3.053~~
~~114~~	~~8.6E-07~~	~~15.962~~	~~-19302~~	~~107.68~~	~~58.91~~	~~85.92~~	~~1942.1~~	~~1895~~	~~197.3~~
~~114~~	~~8.6E-07~~	~~9.08E-07~~	~~4269.1~~	~~314.44~~	~~35.27~~	~~43.58~~	~~162.98~~	~~3.318~~	~~3.163~~
~~116~~	~~1.32E-06~~	~~15.916~~	~~-19130~~	~~109.17~~	~~58.89~~	~~86.04~~	~~1928.5~~	~~1747~~	~~196.4~~
~~116~~	~~1.32E-06~~	~~1.37E-06~~	~~4356.6~~	~~311.64~~	~~35.58~~	~~43.90~~	~~164.27~~	~~3.368~~	~~3.274~~
~~118~~	~~1.99E-06~~	~~15.870~~	~~-18957~~	~~110.65~~	~~58.87~~	~~86.17~~	~~1914.9~~	~~1616~~	~~195.4~~
~~118~~	~~1.99E-06~~	~~2.03E-06~~	~~4444.7~~	~~308.97~~	~~35.89~~	~~44.21~~	~~165.54~~	~~3.417~~	~~3.386~~
~~120~~	~~2.96E-06~~	~~15.825~~	~~-18785~~	~~112.09~~	~~58.86~~	~~86.29~~	~~1901.3~~	~~1500~~	~~194.4~~
~~120~~	~~2.96E-06~~	~~2.97E-06~~	~~4533.4~~	~~306.42~~	~~36.20~~	~~44.52~~	~~166.80~~	~~3.467~~	~~3.500~~
~~122~~	~~4.34E-06~~	~~15.779~~	~~-18612~~	~~113.52~~	~~58.85~~	~~86.42~~	~~1887.8~~	~~1397~~	~~193.5~~
~~122~~	~~4.34E-06~~	~~4.28E-06~~	~~4622.7~~	~~303.97~~	~~36.51~~	~~44.82~~	~~168.05~~	~~3.516~~	~~3.614~~
~~124~~	~~6.28E-06~~	~~15.733~~	~~-18439~~	~~114.93~~	~~58.84~~	~~86.55~~	~~1874.2~~	~~1305~~	~~192.5~~
~~124~~	~~6.28E-06~~	~~6.09E-06~~	~~4712.7~~	~~301.64~~	~~36.81~~	~~45.13~~	~~169.30~~	~~3.566~~	~~3.730~~
~~126~~	~~8.97E-06~~	~~15.687~~	~~-18266~~	~~116.31~~	~~58.84~~	~~86.68~~	~~1860.7~~	~~1222~~	~~191.4~~
~~126~~	~~8.97E-06~~	~~8.56E-06~~	~~4803.2~~	~~299.40~~	~~37.11~~	~~45.43~~	~~170.53~~	~~3.616~~	~~3.847~~
~~128~~	~~1.26E-05~~	~~15.641~~	~~-18093~~	~~117.68~~	~~58.84~~	~~86.82~~	~~1847.2~~	~~1147~~	~~190.4~~
~~128~~	~~1.26E-05~~	~~1.19E-05~~	~~4894.3~~	~~297.27~~	~~37.41~~	~~45.72~~	~~171.75~~	~~3.666~~	~~3.966~~
~~130~~	~~1.76E-05~~	~~15.595~~	~~-17919~~	~~119.03~~	~~58.84~~	~~86.96~~	~~1833.7~~	~~1079~~	~~189.4~~
~~130~~	~~1.76E-05~~	~~1.63E-05~~	~~4986.0~~	~~295.22~~	~~37.70~~	~~46.02~~	~~172.96~~	~~3.717~~	~~4.085~~
~~132~~	~~2.43E-05~~	~~15.550~~	~~-17745~~	~~120.36~~	~~58.84~~	~~87.10~~	~~1820.3~~	~~1018~~	~~188.3~~
~~132~~	~~2.43E-05~~	~~2.21E-05~~	~~5078.3~~	~~293.26~~	~~38.00~~	~~46.31~~	~~174.17~~	~~3.767~~	~~4.205~~
~~134~~	~~3.31E-05~~	~~15.504~~	~~-17570~~	~~121.67~~	~~58.84~~	~~87.24~~	~~1806.8~~	~~962.4~~	~~187.2~~
~~134~~	~~3.31E-05~~	~~2.97E-05~~	~~5171.2~~	~~291.38~~	~~38.29~~	~~46.60~~	~~175.36~~	~~3.818~~	~~4.327~~
~~136~~	~~4.46E-05~~	~~15.458~~	~~-17396~~	~~122.96~~	~~58.85~~	~~87.38~~	~~1793.4~~	~~911.5~~	~~186.1~~
~~136~~	~~4.46E-05~~	~~3.95E-05~~	~~5264.6~~	~~289.58~~	~~38.58~~	~~46.89~~	~~176.54~~	~~3.868~~	~~4.450~~
~~138~~	~~5.97E-05~~	~~15.412~~	~~-17221~~	~~124.24~~	~~58.86~~	~~87.53~~	~~1780~~	~~865.0~~	~~185.0~~

TABLE 1 *Continued*

T K	*p* MPa	ρ mol·l^{-1}	*H* J·mol^{-1}	*S* J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	*c* m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
138	5.97E-05	5.2E-05	5358.6	287.86	38.86	47.18	177.72	3.919	4.574
140	7.9E-05	15.366	-17046	125.50	58.88	87.68	1766.6	822.2	183.9
140	7.9E-05	6.79E-05	5453.1	286.20	39.15	47.46	178.88	3.970	4.699
142	0.000104	15.320	-16870	126.74	58.89	87.83	1753.2	782.9	182.8
142	0.000104	8.78E-05	5548.1	284.62	39.43	47.75	180.04	4.021	4.825
144	0.000135	15.275	-16694	127.97	58.91	87.98	1739.8	746.6	181.7
144	0.000135	0.000113	5643.7	283.10	39.71	48.03	181.18	4.072	4.953
146	0.000174	15.229	-16518	129.19	58.93	88.14	1726.4	713.1	180.5
146	0.000174	0.000143	5739.9	281.64	39.99	48.32	182.32	4.123	5.081
148	0.000223	15.183	-16342	130.39	58.95	88.30	1713.0	682.0	179.4
148	0.000223	0.000181	5836.5	280.24	40.27	48.60	183.45	4.174	5.211
150	0.000283	15.137	-16165	131.57	58.98	88.46	1699.7	653.1	178.2
150	0.000283	0.000227	5933.6	278.90	40.55	48.88	184.57	4.226	5.342
152	0.000358	15.091	-15988	132.75	59.01	88.62	1686.3	626.2	177.1
152	0.000358	0.000283	6031.3	277.61	40.83	49.16	185.67	4.277	5.474
154	0.000448	15.044	-15811	133.91	59.04	88.79	1672.9	601.1	175.9
154	0.000448	0.00035	6129.4	276.37	41.11	49.45	186.77	4.329	5.607
156	0.000559	14.998	-15633	135.05	59.08	88.96	1659.6	577.7	174.7
156	0.000559	0.000431	6228.0	275.19	41.39	49.73	187.86	4.380	5.741
158	0.000691	14.952	-15455	136.19	59.12	89.13	1646.2	555.7	173.5
158	0.000691	0.000527	6327.1	274.05	41.67	50.02	188.94	4.432	5.877
160	0.00085	14.906	-15276	137.31	59.16	89.31	1632.9	535.0	172.3
160	0.00085	0.00064	6426.6	272.95	41.95	50.30	190.01	4.483	6.013
162	0.00104	14.859	-15097	138.42	59.20	89.49	1619.5	515.6	171.1
162	0.00104	0.000773	6526.6	271.90	42.23	50.59	191.06	4.535	6.151
164	0.001265	14.813	-14918	139.52	59.26	89.67	1606.1	497.3	169.9
164	0.001265	0.000929	6627.0	270.89	42.51	50.88	192.11	4.586	6.290
166	0.00153	14.766	-14739	140.61	59.31	89.86	1592.7	480.1	168.7
166	0.00153	0.00111	6727.8	269.92	42.80	51.17	193.14	4.638	6.429
168	0.001841	14.719	-14559	141.68	59.37	90.05	1579.4	463.8	167.5
168	0.001841	0.00132	6829.1	268.99	43.08	51.46	194.17	4.690	6.570
170	0.002204	14.673	-14379	142.75	59.43	90.25	1566.0	448.4	166.3
170	0.002204	0.001563	6930.7	268.10	43.37	51.76	195.18	4.742	6.712
172	0.002627	14.626	-14198	143.81	59.50	90.45	1552.6	433.8	165.1
172	0.002627	0.001841	7032.7	267.24	43.65	52.06	196.18	4.793	6.855
174	0.003116	14.579	-14017	144.85	59.57	90.65	1539.2	419.9	163.8
174	0.003116	0.00216	7135.1	266.42	43.94	52.36	197.17	4.845	7.000
176	0.00368	14.532	-13835	145.89	59.65	90.86	1525.9	406.7	162.6
176	0.00368	0.002523	7237.8	265.62	44.23	52.66	198.15	4.897	7.145
178	0.004327	14.485	-13653	146.92	59.73	91.07	1512.5	394.2	161.4
178	0.004327	0.002935	7340.8	264.86	44.53	52.98	199.11	4.948	7.291
180	0.005068	14.437	-13471	147.94	59.81	91.29	1499.1	382.2	160.2
180	0.005068	0.0034	7444.2	264.13	44.82	53.29	200.06	5.000	7.439
182	0.005912	14.390	-13288	148.95	59.90	91.52	1485.7	370.8	158.9
182	0.005912	0.003924	7547.9	263.43	45.12	53.61	200.99	5.052	7.587
184	0.006869	14.342	-13105	149.95	60.00	91.74	1472.3	359.9	157.7
184	0.006869	0.004513	7651.8	262.76	45.43	53.93	201.92	5.103	7.737
186	0.007953	14.295	-12921	150.94	60.10	91.98	1459.0	349.6	156.5
186	0.007953	0.005172	7756.0	262.11	45.73	54.26	202.82	5.155	7.887

TABLE 1 *Continued*

T K	*p* MPa	ρ mol·l^{-1}	*H* J·mol^{-1}	*S* J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	*c* m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
188	0.009174	14.247	-12737	151.93	60.21	92.22	1445.6	339.6	155.2
188	0.009174	0.005907	7860.5	261.49	46.04	54.60	203.71	5.206	8.039
190	0.010547	14.199	-12552	152.90	60.32	92.46	1432.2	330.1	154.0
190	0.010547	0.006724	7965.2	260.89	46.35	54.94	204.59	5.258	8.192
192	0.012085	14.151	-12367	153.87	60.44	92.71	1418.9	321.0	152.8
192	0.012085	0.00763	8070.1	260.31	46.67	55.28	205.45	5.309	8.345
194	0.013802	14.102	-12181	154.84	60.56	92.97	1405.5	312.2	151.5
194	0.013802	0.008632	8175.2	259.76	46.99	55.64	206.30	5.361	8.500
196	0.015715	14.054	-11995	155.79	60.69	93.23	1392.2	303.8	150.3
196	0.015715	0.009737	8280.5	259.23	47.31	56.00	207.12	5.412	8.656
198	0.017839	14.005	-11808	156.74	60.83	93.50	1378.8	295.8	149.1
198	0.017839	0.010952	8386.0	258.73	47.64	56.36	207.93	5.464	8.813
200	0.020192	13.957	-11620	157.68	60.97	93.78	1365.5	288.0	147.8
200	0.020192	0.012285	8491.6	258.24	47.98	56.74	208.73	5.515	8.971
202	0.022791	13.908	-11432	158.61	61.11	94.06	1352.2	280.5	146.6
202	0.022791	0.013744	8597.4	257.77	48.31	57.12	209.50	5.566	9.130
204	0.025655	13.858	-11244	159.54	61.26	94.35	1338.9	273.3	145.4
204	0.025655	0.015337	8703.3	257.32	48.65	57.50	210.26	5.617	9.290
206	0.028803	13.809	-11055	160.46	61.42	94.65	1325.7	266.4	144.2
206	0.028803	0.017073	8809.2	256.89	49.00	57.90	210.99	5.668	9.451
208	0.032255	13.76o	-10865	161.38	61.58	94.96	1312.4	259.7	142.9
208	0.032255	0.018961	8915.3	256.47	49.35	58.30	211.71	5.720	9.614
210	0.036032	13.710	-10674	162.29	61.74	95.27	1299.2	253.3	141.7
210	0.036032	0.021009	9021.4	256.08	49.70	58.71	212.41	5.771	9.777
212	0.040156	13.660	-10483	163.19	61.91	95.59	1285.9	247.1	140.5
212	0.040156	0.023227	9127.6	255.70	50.06	59.13	213.08	5.822	9.942
214	0.044649	13.610	-10292	164.09	62.09	95.92	1272.7	241.1	139.3
214	0.044649	0.025625	9233.8	255.33	50.42	59.56	213.74	5.873	10.11
216	0.049534	13.56	-10099	164.98	62.27	96.25	1259.5	235.3	138.1
216	0.049534	0.028212	9340	254.98	50.79	59.99	214.37	5.924	10.27
218	0.054834	13.509	-9906.3	165.87	62.45	96.60	1246.4	229.7	136.9
218	0.054834	0.030998	9446.2	254.64	51.16	60.43	214.98	5.975	10.440
220	0.060574	13.458	-9712.5	166.75	62.64	96.95	1233.2	224.2	135.7
220	0.060574	0.033994	9552.4	254.32	51.54	60.88	215.57	6.026	10.61
222	0.06678	13.407	-9518.0	167.63	62.84	97.31	1220.1	219.0	134.5
222	0.06678	0.03721	9658.6	254.01	51.91	61.34	216.14	6.077	10.78
224	0.073476	13.356	-9322.7	168.51	63.04	97.68	1206.9	213.9	133.3
224	0.073476	0.040658	9764.7	253.72	52.30	61.80	216.68	6.128	10.95
226	0.080689	13.304	-9126.7	169.37	63.24	98.05	1193.8	209.0	132.1
226	0.080689	0.044349	9870.7	253.43	52.68	62.28	217.20	6.180	11.13
228	0.088447	13.252	-8929.8	170.24	63.45	98.44	1180.7	204.2	131.0
228	0.088447	0.048293	9976.6	253.16	53.08	62.76	217.69	6.231	11.30
230	0.096776	13.200	-8732.2	171.10	63.66	98.83	1167.6	199.6	129.8
230	0.096776	0.052503	10082	252.90	53.47	63.26	218.16	6.282	11.48
232	0.1057	13.148	-8533.8	171.95	63.88	99.24	1154.5	195.1	128.6
232	0.1057	0.056991	10188	252.65	53.87	63.76	218.61	6.333	11.65
234	0.11526	13.095	-8334.5	172.81	64.10	99.65	1141.5	190.7	127.5
234	0.11526	0.06177	10294	252.41	54.27	64.27	219.03	6.385	11.83
236	0.12548	13.042	-8134.4	173.66	64.33	100.07	1128.4	186.5	126.3
236	0.12548	0.066851	10399	252.19	54.68	64.79	219.42	6.436	12.01

TABLE 1 *Continued*

T K	*p* MPa	ρ mol·l^{-1}	*H* J·mol^{-1}	*S* J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	*c* m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
238	0.13638	12.989	-7933.4	174.50	64.56	100.50	1115.3	182.4	125.2
238	0.13638	0.072248	10504	251.97	55.09	65.32	219.79	6.488	12.19
240	0.148	12.935	-7731.5	175.34	64.79	100.94	1102.3	178.4	124.0
240	0.148	0.077974	10609	251.76	55.50	65.86	220.12	6.540	12.38
242	0.16037	12.881	-7528.7	176.18	65.03	101.39	1089.2	174.5	122.9
242	0.16037	0.084043	10714	251.56	55.92	66.411	220.43	6.592	12.56
244	0.17352	12.827	-7325	177.01	65.27	101.86	1076.2	170.7	121.7
244	0.17352	0.090469	10818	251.37	56.34	66.972	220.72	6.644	12.75
246	0.18748	12.772	-7120.3	177.84	65.52	102.33	1063.1	167.1	120.6
246	0.18748	0.097266	10922	251.19	56.77	67.54	220.97	6.697	12.94
248	0.20228	12.717	-6914.6	178.67	65.77	102.81	1050.1	163.5	119.5
248	0.20228	0.10445	11026	251.01	57.20	68.13	221.20	6.750	13.13
250	0.21796	12.662	-6707.9	179.50	66.03	103.30	1037.1	160.0	118.4
250	0.21796	0.11203	11130	250.85	57.63	68.72	221.39	6.803	13.32
252	0.23455	12.606	-6500.2	180.32	66.29	103.81	1024.0	156.6	117.3
252	0.23455	0.12004	11233	250.69	58.06	69.33	221.56	6.856	13.52
254	0.25209	12.550	-6291.5	181.14	66.56	104.32	1010.9	153.3	116.2
254	0.25209	0.12847	11335	250.54	58.51	69.95	221.69	6.910	13.72
256	0.2706	12.493	-6081.7	181.96	66.82	104.85	997.87	150.1	115.1
256	0.2706	0.13736	11438	250.39	58.95	70.583	221.79	6.964	13.92
258	0.29012	12.436	-5870.9	182.77	67.10	105.39	984.80	147.0	114.0
258	0.29012	0.14671	11540	250.25	59.40	71.23	221.86	7.018	14.12
260	0.31068	12.379	-5658.9	183.58	67.38	105.94	971.73	143.9	112.9
260	0.31068	0.15655	11641	250.12	59.85	71.89	221.90	7.073	14.32
262	0.33233	12.32	-5445.8	184.39	67.66	106.51	958.64	141.0	111.8
262	0.33233	0.1669	11742	249.99	60.31	72.57	221.90	7.128	14.53
264	0.35509	12.262	-5231.5	185.20	67.94	107.09	945.54	138.0	110.8
264	0.35509	0.17776	11842	249.87	60.77	73.26	221.88	7.184	14.74
266	0.37901	12.203	-5016	186.00	68.24	107.69	932.43	135.2	109.7
266	0.37901	0.18917	11942	249.76	61.24	73.98	221.81	7.240	14.95
268	0.40411	12.143	-4799.4	186.81	68.53	108.30	919.32	132.4	108.6
268	0.40411	0.20115	12042	249.65	61.71	74.70	221.71	7.298	15.17
270	0.43043	12.083	-4581.5	187.61	68.83	108.92	906.18	129.7	107.6
270	0.43043	0.21371	12140	249.54	62.18	75.45	221.58	7.355	15.39
272	0.45801	12.023	-4362.3	188.41	69.13	109.56	893.04	127.1	106.6
272	0.45801	0.22687	12238	249.44	62.66	76.22	221.41	7.414	15.61
274	0.48689	11.961	-4141.8	189.21	69.44	110.22	879.88	124.5	105.5
274	0.48689	0.24067	12336	249.35	63.15	77.01	221.20	7.473	15.84
276	0.51711	11.899	-3920	190.01	69.76	110.89	866.70	122.0	104.5
276	0.51711	0.25513	12432	249.25	63.64	77.82	220.96	7.533	16.07
278	0.54869	11.837	-3696.9	190.80	70.07	111.59	853.50	119.5	103.5
278	0.54869	0.27026	12528	249.17	64.14	78.66	220.68	7.593	16.30
280	0.58169	11.774	-3472.3	191.60	70.39	112.30	840.29	117.1	102.5
280	0.58169	0.28611	12623	249.08	64.64	79.52	220.36	7.655	16.54
282	0.61613	11.710	-3246.4	192.39	70.72	113.04	827.06	114.7	101.5
282	0.61613	0.30269	12717	249.00	65.15	80.40	220.00	7.718	16.79
284	0.65205	11.645	-3018.9	193.18	71.05	113.79	813.81	112.4	100.5
284	0.65205	0.32003	12810	248.92	65.66	81.32	219.59	7.782	17.04
286	0.68951	11.580	-2790.0	193.98	71.38	114.57	800.53	110.1	99.5

TABLE 1 *Continued*

T K	*p* MPa	ρ mol·l^{-1}	*H* J·mol^{-1}	*S* J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	*c* m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
286	0.68951	0.33817	12903	248.85	66.18	82.27	219.15	7.846	17.29
288	0.72852	11.514	-2559.6	194.77	71.72	115.38	787.23	107.8	98.5
288	0.72852	0.35715	12994	248.77	66.71	83.25	218.67	7.913	17.55
290	0.76914	11.447	-2327.5	195.56	72.07	116.21	773.90	105.7	97.6
290	0.76914	0.37698	13084	248.70	67.24	84.27	218.14	7.980	17.81
292	0.8114	11.380	-2093.9	196.35	72.41	117.06	760.55	103.5	96.6
292	0.8114	0.39772	13173	248.63	67.78	85.32	217.57	8.049	18.08
294	0.85535	11.311	-1858.6	197.14	72.77	117.95	747.16	101.4	95.7
294	0.85535	0.41940	13261	248.57	68.33	86.42	216.95	8.119	18.36
296	0.90101	11.242	-1621.6	197.93	73.12	118.87	733.75	99.32	94.7
296	0.90101	0.44206	13348	248.50	68.88	87.56	216.29	8.191	18.65
298	0.94844	11.171	-1382.8	198.72	73.48	119.82	720.30	97.28	93.8
298	0.94844	0.46575	13433	248.44	69.45	88.75	215.58	8.265	18.94
300	0.99768	11.100	-1142.2	199.51	73.85	120.80	706.81	95.28	92.9
300	0.99768	0.49051	13517	248.37	70.02	89.99	214.82	8.340	19.24
302	1.0488	11.027	-899.8	200.30	74.22	121.83	693.28	93.31	91.9
302	1.0488	0.5164	13600	248.31	70.60	91.28	214.02	8.417	19.54
304	1.1017	10.954	-655.4	201.09	74.60	122.90	679.71	91.37	91.0
304	1.1017	0.54347	13681	248.25	71.18	92.64	213.16	8.497	19.86
306	1.1567	10.879	-409.0	201.88	74.98	124.01	666.09	89.46	90.1
306	1.1567	0.57177	13760	248.18	71.78	94.06	212.26	8.578	20.18
308	1.2135	10.803	-160.6	202.67	75.36	125.18	652.42	87.57	89.2
308	1.2135	0.60137	13838	248.12	72.38	95.56	211.30	8.663	20.52
310	1.2724	10.726	90.0	203.46	75.75	126.40	638.70	85.72	88.3
310	1.2724	0.63234	13914	248.06	73.00	97.14	210.28	8.749	20.86
312	1.3334	10.647	342.7	204.26	76.15	127.68	624.91	83.89	87.4
312	1.3334	0.66475	13988	247.99	73.62	98.80	209.21	8.839	21.22
314	1.3965	10.567	597.8	205.05	76.55	129.02	611.07	82.08	86.6
314	1.3965	0.69869	14060	247.93	74.26	100.56	208.09	8.932	21.59
316	1.4617	10.485	855.2	205.85	76.96	130.44	597.16	80.29	85.68
316	1.4617	0.73423	14129	247.86	74.91	102.43	206.91	9.027	21.97
318	1.5292	10.402	1115.1	206.65	77.38	131.93	583.18	78.53	84.8
318	1.5292	0.77149	14197	247.79	75.57	104.41	205.66	9.127	22.37
320	1.5989	10.317	1377.6	207.45	77.80	133.52	569.12	76.78	83.9
320	1.5989	0.81055	14261	247.72	76.24	106.53	204.35	9.230	22.78
322	1.6708	10.230	1642.9	208.26	78.23	135.20	554.97	75.05	83.1
322	1.6708	0.85155	14323	247.64	76.92	108.80	202.98	9.337	23.21
324	1.7452	10.141	1911.0	209.07	78.67	137.00	540.74	73.34	82.2
324	1.7452	0.89461	14382	247.56	77.62	111.24	201.55	9.449	23.66
326	1.8219	10.051	2182.0	209.88	79.12	138.93	526.40	71.64	81.4
326	1.8219	0.93987	14438	247.47	78.32	113.87	200.04	9.566	24.13
328	1.9011	9.9574	2456.3	210.69	79.57	141.00	511.96	69.95	80.5
328	1.9011	0.9875	14491	247.38	79.04	116.71	198.47	9.688	24.616
330	1.9828	9.8617	2733.9	211.51	80.04	143.24	497.40	68.28	79.7
330	1.9828	1.0377	14540	247.29	79.78	119.81	196.82	9.816	25.13
332	2.0671	9.7634	3015.0	212.33	80.52	145.67	482.72	66.61	78.9
332	2.0671	1.0906	14585	247.18	80.52	123.20	195.10	9.951	25.67
334	2.154	9.6622	3300.0	213.16	81.00	148.33	467.90	64.95	78.0
334	2.154	1.1466	14626	247.07	81.28	126.93	193.30	10.09	26.25